CLAIMS

1. A device for the formation of advanced oxidation product, the device comprising:

an ultraviolet light source for emitting a broad spectrum of ultraviolet light with wavelengths between 100 nm and 300 nm, the ultraviolet light emitted from the ultraviolet light source includes ultraviolet light energy at about 185 nm and at about 254 nm; and

a catalytic target structure, mechanically coupled to the ultraviolet light source and including a surface, the surface of the catalytic target structure comprising titanium dioxide and at least one of the following metallic compounds:

silver;

copper; and

rhodium,

and wherein the surface of the catalytic target structure after contact with ultraviolet light reacts with hydrate at the surface to form advanced oxidation product.

2. The device of claim 1, wherein the surface of the catalytic target structure comprises titanium dioxide and a plurality of the following metallic compounds:

silver;

copper; and

rhodium.

3. The device of claim 1, wherein the surface of the catalytic target structure comprises titanium dioxide, silver, copper, and rhodium.

4. The device of claim 3, wherein the surface of the catalytic target structure comprises a hydrophilic agent.

5. The device of claim 4, wherein the hydrophilic agent comprises Silica Gel.

6. The device of claim 1, wherein the surface of the catalytic target structure comprises a hydrophilic agent.

7. The device of claim 6, wherein the hydrophilic agent comprises Silica Gel.

8. The device of claim 1, wherein the surface of the catalytic target structure is hydrated by a hydrating agent at the surface, and wherein the surface after contact with ultraviolet light reacts with hydrate from the hydrating agent at the surface to form advanced oxidation product.

9. The device of claim 8, wherein the hydrating agent comprises water at the surface of the catalytic target structure.

10. The device of claim 8, wherein the hydrating agent comprises at least one of moisture and humidity, at the surface of the catalytic target structure.

11. The device of claim 8, wherein the hydrating agent comprises a hydrophilic agent at the surface of the catalytic target structure.

12. The device of claim 11, wherein the hydrophilic agent comprises Silica Gel.

13. The device of claim 1, wherein the surface of the catalytic target structure is coated with a coating comprising the titanium dioxide and at least one of the following metallic compounds:

silver;

copper; and

rhodium,

and wherein the surface after contact with ultraviolet light reacts with hydrate at the surface to form advanced oxidation product.

14. The device of claim 13, wherein the coating comprises titanium dioxide and a plurality of the following metallic compounds:

silver;

copper; and

rhodium.

15. The device of claim 13, wherein the coating comprises titanium dioxide, silver, copper, and rhodium.

16. The device of claim 13, wherein the coating further comprises a hydrophilic agent.

17. The device of claim 16, wherein the hydrophilic agent comprises Silica Gel.

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18. A photohydroionization cell comprising:

an ultraviolet light source for providing broad spectrum ultraviolet light with UV light in the 100 nm to 300 nm range that includes ultraviolet light energy at about 185 nm and at about 254 nm; and

a catalytic target structure mechanically coupled to and substantially surrounding the ultraviolet light source, the catalytic target structure including a surface that after contact with ultraviolet light reacts with hydrate at the surface to form advanced oxidation product.

19. The photohydroionization cell of claim 18, wherein a surface of the catalytic target structure is for contact with the ultraviolet light provided by the ultraviolet light source for reacting with hydrate at such surface to form advanced oxidation product.

20. The photohydroionization cell of claim 18, wherein the surface of the catalytic target structure is designed for substantially maximum catalytic surface contact with the ultraviolet light provided by the ultraviolet light source.

21. The photohydroionization cell of claim 20, wherein the surface of the catalytic target structure includes at least one of a ridged and a pleated design, to substantially maximize catalytic surface contact with the ultraviolet light provided by the ultraviolet light source.

22. The photohydroionization cell of claim 18, wherein the surface of the catalytic target structure is designed for contact with ultraviolet light provided by the ultraviolet light source, and wherein such surface of the catalytic target structure comprises catalytic surface area for contact with the ultraviolet light from the ultraviolet light source and open area to allow ultraviolet light from the ultraviolet light source to pass through the open area.

23. The photohydroionization cell of claim 22, wherein the catalytic target structure comprises a total surface area that includes

catalytic surface area for contact with ultraviolet light from the ultraviolet light source, and

open area that is between 0% and 95% of the total surface area.

24. The photohydroionization cell of claim 18, further comprising:

a fiber optic cable with

a first end oriented to receive light emitted from the ultraviolet light source, and

a second end providing an output light signal indicative of the operating status of the photohydroionization cell.

25. The photohydroionization cell of claim 24, further comprising:

U.V. light filtering means for substantially filtering U.V. light, while passing visible light that is visible by a person, the fiber optic cable cooperatively operating with the U.V. light filtering means for providing the visible light as the output light signal from the second end of the fiber optic signal.

26. The photohydroionization cell of claim 25, wherein the U.V. light filtering means comprises at least one of

a U.V. filter, and

U.V. filtering material in the fiber optic cable.

27. The photohydroionization cell of claim 18, further comprising:

a protective barrier substantially encasing the ultraviolet light source, the protective barrier being substantially transparent to UV light for substantially passing UV light emitted from the UV light source at least within the UV light range in the 100 nm to 300 nm range while at the same time insulating the encased UV light source from external temperature.

28. The photohydroionization cell of claim 27, wherein the protective barrier comprises at least one of a protective coating and a tube that substantially encases the UV light source.

29. The photohydroionization cell of claim 28, wherein the protective barrier comprises a fluorocarbon protective barrier coating.

30. The photohydroionization cell of claim 28, wherein the protective barrier comprises quartz material.

31. The photohydroionization cell of claim 28, wherein the protective barrier comprises an anti-fouling external surface that substantially encases the UV light source to deter debris and other contaminants from contacting and adhering to the external surface encasing the UV light source while substantially passing UV light emitted from the UV light source at least within the UV light range in the 100 nm to 300 nm range.

32. The photohydroionization cell of claim 28, wherein the protective barrier provides a containment barrier in the event that the inner UV light source 204 is broken.

33. A mixture of compounds for providing a coating for a surface of a catalytic target structure, the mixture comprising titanium dioxide and at least one of the following compounds: silver, copper, and rhodium, and wherein the coating at the surface of a catalytic target structure is reactive to contact with ultraviolet light and a hydrate to form advanced oxidation product.

34. A mixture of compounds for providing a coating for a surface of a catalytic target structure, the mixture comprising a hydrophilic agent and at least one of the following compounds: titanium dioxide, silver, copper, and rhodium, and wherein the coating at the surface of a catalytic target structure is reactive to contact with ultraviolet light and a hydrate to form advanced oxidation product.

35. The mixture of claim 34, wherein the mixture comprises the hydrophilic agent and titanium dioxide, silver, copper, and rhodium.

36. A system for the formation of advanced oxidation product, the system comprising:

at least one ultraviolet light source for emitting broad spectrum ultraviolet light in the 100 nm to 300 nm range, the ultraviolet light emitted from the at least one ultraviolet light source including ultraviolet light energy at about 185 nm and at about 254 nm; and

at least one catalytic target structure including a surface for contact by ultraviolet light from the at least one ultraviolet light source, the surface of the at least one catalytic target structure comprising titanium dioxide and at least one of the following metallic compounds:

silver;

copper; and

rhodium,

and wherein the surface of the at least one catalytic target structure after contact with ultraviolet light reacts with hydrate at the surface to form advanced oxidation product.

37. The system of claim 36, wherein the surface of the at least one catalytic target structure is coated with a coating including titanium dioxide and at least one of the following metallic compounds:

silver;

copper; and

rhodium.

38. The system of claim 36, wherein the surface of the at least one catalytic target structure is coated with a coating including a hydrophilic agent, titanium dioxide, silver, copper, and rhodium.

39. The system of claim 36, comprising:

a plurality of ultraviolet light sources for emitting broad spectrum ultraviolet light in the 100 nm to 300 nm range, the ultraviolet light emitted from at least one of the plurality of ultraviolet light sources including ultraviolet light energy at about 185 nm and at about 254 nm; and

at least one catalytic target structure including a surface for contact by ultraviolet light from the plurality of ultraviolet light sources, the surface of the at least one catalytic target structure comprising titanium dioxide and at least one of the following metallic compounds:

silver;

copper; and

rhodium,

and wherein the surface of the at least one catalytic target structure after contact with ultraviolet light reacts with hydrate at the surface to form advanced oxidation product.

40. The system of claim 39, wherein the surface of the at least one catalytic target structure further comprising a hydrophilic agent.

41. The system of claim 36, comprising:

a plurality of ultraviolet light sources for emitting a broad spectrum ultraviolet light in the 100 nm to 300 nm range, the ultraviolet light emitted from at least one of the plurality of ultraviolet light sources including ultraviolet light energy at about 185 nm and at about 254 nm; and

a plurality of catalytic target structures, each of the plurality of catalytic target structures including a surface for contact by ultraviolet light from at least one of the plurality of ultraviolet light sources, the surface comprising titanium dioxide and at least one of the following metallic compounds:

silver;

copper; and

rhodium,

and wherein the surface after contact with ultraviolet light reacts with hydrate at the surface to form advanced oxidation product.

42. The system of claim 41, wherein the surface further comprising a hydrophilic agent.

43. A method for forming advanced oxidation product at a catalytic surface, the catalytic surface comprising titanium dioxide and at least one of the following metallic compounds: silver, copper, and rhodium, the method comprising:

hydrating the catalytic surface;

contacting the catalytic surface with ultraviolet light; and

forming advanced oxidation product at the catalytic surface.

44. The method of claim 43, wherein the hydrating the catalytic surface includes hydrophilically absorbing hydrate from an atmosphere surrounding the catalytic surface.

45. The method of claim 43, wherein the ultraviolet light includes ultraviolet light energy at about 185 nm and at about 254 nm.

46. The method of claim 43, wherein the catalytic surface comprises titanium dioxide, silver, copper, and rhodium.

47. The method of claim 43, wherein the catalytic surface comprises a hydrophilic agent, titanium dioxide, silver, copper, and rhodium.

48. A system for the formation of advanced oxidation product, the system comprising:

at least one ultraviolet light source for emitting broad spectrum ultraviolet light in the 100 nm to 300 nm range, the ultraviolet light emitted from the at least one ultraviolet light source including ultraviolet light energy at about 185 nm and at about 254 nm;

at least one catalytic target structure including a surface for contact by ultraviolet light from the at least one ultraviolet light source, the surface of the at least one catalytic target structure comprising titanium dioxide and at least one of the following metallic compounds:

silver;

copper; and

rhodium,

and wherein the surface of the at least one catalytic target structure after contact with ultraviolet light reacts with hydrate at the surface to form advanced oxidation product; and

a fiber optic cable, mechanically coupled with each of the at least one ultraviolet light source, the fiber optic cable including:

a first end oriented to receive light emitted from respective each of the ultraviolet light source, and

a second end providing an output light signal indicative of the operating status of the photohydroionization cell.

49. The system for the formation of advanced oxidation product of claim 48, further comprising:

U.V. light filtering means for substantially filtering U.V. light, while passing visible light that is visible by a person, the fiber optic cable cooperatively operating with the U.V. light filtering means for providing the visible light as the output light signal from the second end of the fiber optic signal.

50. The system for the formation of advanced oxidation product of claim 48, further comprising:

an adjustable power supply, electrically coupled to the at least one ultraviolet light source, for providing an adjustable electrical power signal thereto.

51. The system for the formation of advanced oxidation product of claim 48, further comprising:

a UV Photo Detector, optically coupled with the second end of the fiber optic cable, for providing an output signal indicative of an operational status of the at least one ultraviolet light source.

52. The system for the formation of advanced oxidation product of claim 51, further comprising:

an adjustable power supply, electrically coupled to the at least one ultraviolet light source, for providing an adjustable electrical power signal thereto; and

a controller, electrically coupled with the adjustable power supply and the UV Photo Detector, for, in response to receiving an output data signal from the UV Photo Detector indicative of an operational status of the at least one ultraviolet light source, controlling the adjustable power supply for providing the adjustable electrical power signal to the at least one ultraviolet light source.

53. The system for the formation of advanced oxidation product of claim 52, further comprising:

information means, coupled with the controller, for, in response to receiving an output data signal from the UV Photo Detector indicative of an operational status of the at least one ultraviolet light source, sending an information/alert signal to a user/operator/technical personnel associated with the system.